U.S. FISH AND WILDLIFE SERVICE
SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: *Astelia waialealae*

COMMON NAME: Pa'iniu

LEAD REGION: Region 1

INFORMATION CURRENT AS OF: July 2005

STATUS/ACTION:

___ Species assessment - determined species did not meet the definition of endangered or threatened under the Act and, therefore, was not elevated to Candidate status

___ New candidate

_X_ Continuing candidate

___ Non-petitioned

_X_ Petitioned - Date petition received: May 11, 2004

__ 90-day positive - FR date:

X 12-month warranted but precluded - FR date: May 11, 2005

N Did the petition request a reclassification of a listed species?

a. Is listing warranted (if yes, see summary of threats below)? yes

b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? yes

c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. We find that the immediate issuance of a proposed rule and timely promulgation of a final rule for this species has been, for the preceding 12 months, and continues to be, precluded by higher priority listing actions. During the past 12 months, most of our national listing budget has been consumed by work on various listing actions to comply with court orders and court-approved settlement agreements, meeting statutory deadlines for petition findings or listing determinations, emergency listing evaluations and determinations and essential litigation-related, administrative, and program management tasks. We will continue to monitor the status of this species as new information becomes available. This review will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures. For information on listing actions taken over the past 12 months, see the discussion of "Progress on Revising the Lists," in the current CNOR which can be viewed on our Internet website (http://endangered.fws.gov).

___ Listing priority change

Former LP: ___

New LP: ___

Date when the species first became a Candidate (as currently defined): 1996

___ Candidate removal: Former LP: __

___ A – Taxon is more abundant or widespread than previously believed or not subject to the degree of threats sufficient to warrant issuance of a proposed listing or

continuance of candidate status.

___U – Taxon not subject to the degree of threats sufficient to warrant issuance of a proposed listing or continuance of candidate status due, in part or totally, to conservation efforts that remove or reduce the threats to the species.

___ F – Range is no longer a U.S. territory.

___ I – Insufficient information exists on biological vulnerability and threats to support listing.

___ M – Taxon mistakenly included in past notice of review.

___ N – Taxon does not meet the Act's definition of "species."

___ X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Flowering plants, Asteliaceae (astelia family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

CURRENT STATES/ COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, island of Kauai

LAND OWNERSHIP:
All three populations are on State-owned land within the Alakai Wilderness Preserve.

LEAD REGION CONTACT: Paul Phifer, 503-872-2823, paul_phifer@fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa_russell@fws.gov

BIOLOGICAL INFORMATION:

Species Description *Astelia waialealae* is a perennial herb. It is short, rhizomatous, from a thick bulbous caudex. The leaves are silvery, 12 to 20 centimeters (cm) (4.7 to 7.9 inches (in)) long, 1.3 to 2.2 cm (0.5 to 0.9 in) wide, with scales on both surfaces. The staminate flowers are in racemes 3 to 7 cm (1.2 to 2.8 in) long and the tepals are dark purple. The pistillate flowers are also in racemes, which are 2.5 to 3 cm (1.0-1.2 in) long, and have dark purple tepals. Berries are orange, ovoid, 8 millimeters (mm) (0.3 in) long, and 4 mm (0.2 in) in diameter (Wagner *et. al.* 1999a). This species was once considered the silversword of Kauai, because the large rosettes of silvery leaves were the size and shape of the genus *Argyroxiphium*.

Taxonomy *Astelia waialealae* was described by Wawra. This species is recognized as a distinct taxon in Wagner *et al.* (1999a) and Wagner and Herbst (2003), the most recently accepted Hawaiian plant taxonomy. In the 2003 supplement to the *Manual of the Flowering Plants of Hawaii*, this genus was moved from the Liliaceae to the Asteliaceae family (Wagner and Herbst 2003).

Habitat *Astelia waialealae* occurs in *Metrosideros polymorpha*-dominated mixed montane bogs on the central plateau of the island of Kauai, with the following associated native species: *Alyxia oliviformis, Astelia menziesiana, Carex alligata, Carex montiseeka, Cheirodendron* sp.,

Coprosma ellliptica, *Dianella sandwicensis*, *Dicranopteris* sp., *Drosera anglica*, *Dubautia paleata*, *Gahnia* sp., *Ilex anomala*, *Korthalsella* sp., *Keysseria* sp., *Lobelia kauaensis*, *Lycopodium cernuum*, *Myrsine denticulata*, *Oreobolus furcatus*, *Plantago* sp., *Rhynchospora chinensis* ssp. *spidiformis*, *Sadleria* sp., *Stenogyne* sp., *Styphelia tameiameiae*, *Vaccinium* sp., *Viola kauaensis*, and *Wikstroemia* sp. and at elevations between 1,220 and 1,525 meters (4,000 and 5,000 feet) (Wagner *et al.* 1999a; Hawaii Natural Heritage Program database 2004).

Historical and Current Range/Current Status *Astelia waialealae* is known from three populations in three bogs within the Alakai swamp region of Kauai. In 2004, these three populations totaled 35 clumps and may only represent 10 to 15 genetically distinct individuals (Marie Bruegmann, U.S. Fish and Wildlife Service (Service), pers. comm. 2004). Thirty of these clumps were found in a single bog (Perlman and Wood 1995; S. Perlman, pers. comm. 2004). In 2005, Hawaii Division of Forestry and Wildlife and Service staff found only 21 clumps, and collected material from 7 for controlled propagation. While the species has always been restricted to the bogs of the Alakai, it may have occurred in additional bogs in the past, as well as in greater numbers, although we do not have any data available on historical abundance. The largest individual, less than 30 cm (12 in) in diameter, is mature but no regeneration in the species has been observed from 1995 to the present. Service and Hawaii Division of Forestry and Wildlife staff have monitored all three populations over the last eight years and the number of genetically distinct individuals has fluctuated very little until the last few years, and is now down to perhaps seven individuals, based on the placement of the clumps (M. Bruegmann, pers. comm. 2005; Service Kauai bog monitoring database 2005).

THREATS:

A. The present or threatened destruction, modification, or curtailment of its habitat or range. Pigs (*Sus scrofa*) are the major threat to *Astelia waialealae* (Perlman and Wood 1995) as they continue to destroy the habitat it needs to develop a sustainable population. As early as 1778, European explorers introduced livestock, which became feral, increased in number and range, and caused significant changes to the natural environment of Hawaii. Past and present activities of introduced alien mammals are the primary factor altering and degrading vegetation and habitat on Kauai. Pigs are currently present on Kauai and four other islands, and inhabit rain forests and grasslands. While rooting in the ground in search of the invertebrates and plant material they eat, feral pigs disturb and destroy vegetative cover, trample plants and seedlings, and threaten forest regeneration by damaging seeds and seedlings. They disturb soil and cause erosion, especially on slopes. Alien plant seeds are dispersed on their hooves and coats as well as through their digestive tracts, and the disturbed soil is fertilized by their feces, helping these plants to establish (Smith 1985; Stone 1985; Medeiros *et al*. 1986; Scott *et al*. 1986; Tomich 1986; Cuddihy and Stone 1990; Wagner *et al*. 1999a). Pigs have been fenced out of the three bogs where *A. waialealae* currently occurs for nine years; however, without continued monitoring and maintenance of those fences as is currently occurring, pigs from surrounding areas can easily access fenced areas. Further, as the population within the fenced area declines, similar habitat outside the fenced area potentially becomes more important as possible sites for relocation. However, this habitat outside the fence is being degraded and destroyed by the feral pigs.

B. Overutilization for commercial, recreational, scientific, or educational purposes.
None known.

C. Disease or predation.
Only seven mature individuals of *Astelia waialealae* remain due to predation by feral pigs and no regeneration has been observed for the past 10 years. The basal rosette of the plant is starchy and may provide a food source for feral pigs. Pigs eat the leaves and base of the plant as well as dig up the roots (Perlman and Wood 1995). Pigs have been fenced out of the three bogs where *A. waialealae* currently occurs; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas.

D. The inadequacy of existing regulatory mechanisms.
The Forest Reserve Act of 1903 was an important action that protected watersheds in Hawaii. This act has been strengthened and re-titled Hawaii Department of Land and Natural Resources Title 13, Chapter 104 Rules Regulating Activities within Forest Reserves and provides protection to native forest values from certain degrading factors caused by human activities. The Hawaii Department of Land and Natural Resources Regulation (Administrative Rule No. 1, Chapter 3) established the 4,022 hectare (9,939 acre) Alakai Wilderness Preserve in 1964, recognizing the pristine forest values of this area and the need to control potential degrading factors. No funding
was obligated along with this law to allow Hawaii Department of Land and Natural Resources to adequately manage the area.

Pig hunting is allowed on all islands either year-round or during certain months, depending on the area (Hawaii Department of Lands and Natural Resources n.d.-a, n.d.-b, n.d.-c, n.d.-d). Hunting is allowed within the Alakai Wilderness, but because of its remoteness and rugged topography, little public hunting is done in the areas where this species occurs. Pigs have been fenced out of the three bogs where *A. waialealae* currently occurs; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily access fenced areas.

E. Other natural or manmade factors affecting its continued existence.
The greatest threat to *Astelia waialealae* is currently the lack of regeneration. Flowering has been observed twice in the last nine years, in two different years, and each time only one female flowered, so no seeds were produced. While this species can reproduce vegetatively, many of the vegetative clones have died over the last nine years for unknown reasons? (M. Bruegmann, pers. comm. 2005).

Nonnative plant species (discussed below) threaten *Astelia waialealae*, although not to the same degree as feral pigs. While there are few nonnative plants in its bog habitat, their numbers are expected to increase if the fenced areas are not maintained (Perlman and Wood 1995). These nonnative plants are being controlled within the three fenced bogs, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands (M. Bruegmann, pers. comm. 2005). Many widespread

alien taxa cannot be completely eradicated from an island or the State, and therefore are expected to disperse into previously managed areas (Loope 1998, Smith 1985).

Juncus planifolius (no common name) is a perennial rush which has naturalized in moist, open, disturbed depressions on margins of forests and in bogs on Kauai, Oahu, Molokai, Maui, and Hawaii (Coffey 1999). *Juncus planifolius* is only found in disturbed areas, so the removal of feral pigs will most likely stem the spread of this species (Perlman and Wood 1995; S. Perlman, pers. comm. 1997).

Andropogon virginicus (broomsedge) is a perennial, tufted grass that is naturalized on Kauai, Oahu, and Hawaii along roadsides and in disturbed dry to mesic forest and shrubland (Clyde Imada, Bernice Pauahi Bishop Museum, pers. comm. 1997; O'Connor 1999). The saturation of soil in the bogs creates a lack of oxygen that inhibits the uptake of water by plant roots, resulting in drought conditions (Joan Canfield, Service, pers. comm. 1996). Broomsedge is beginning to establish in the bogs of the Alakai that are most easily accessible to humans and may become a threat to *Astelia waialealae* if disturbance to the bogs continues (Perlman and Wood 1995).

While we do not have direct documentation of decline in this species due to the presence of alien pest plants, including those mentioned here, numerous studies have shown that alien pest plants can outcompete almost any native species that has been studied in both Hawaii and other tropical islands. In addition, they often radically alter the habitat so that it is no longer suitable for the native species (Smathers and Gardner 1978; Smith 1985; Loope and Medeiros 1992; Medeiros *et al*. 1992; Ellshoff *et al*. 1995; Meyer and Florence 1996; Medeiros *et al.* 1997; Loope *et al*. 2004).

In addition, species like *Astelia waialealae* that are endemic to single small islands are inherently more vulnerable to extinction than widespread species because of the higher risks posed to a few populations and individuals by genetic bottlenecks, random demographic fluctuations and localized catastrophes such as hurricanes. When considered on their own, the natural processes associated with being a single island endemic and the habitat perturbation caused by hurricanes do not affect *Astelia waialealae* to such a degree that it is threatened or endangered with extinction in the foreseeable future, but these natural processes can exacerbate the threat from anthropogenic factors, such as habitat loss for human development or predation by nonnative species. For *A. waialealae,* stochastic events are an even greater threat because the species is not regenerating and has such low numbers.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

The Service, working in cooperation with the State of Hawaii, Division of Forestry and Wildlife, has fenced the three bogs where *Astelia waialealae* currently occurs. Funding was made available from the Service's Portland Regional Office in fiscal year 1995 to do this fencing. Biannual monitoring, weed control, and fence maintenance have been conducted since then by the Service and the State's Division of Forestry and Wildlife. Additional funding will be required for annual monitoring, fence maintenance, and weed control. In February 2005, seven cuttings were collected for controlled propagation and delivered to the Volcano Rare Plant Facility. As of June 2005, all but one of the cuttings is doing well (Patty Moriyasu, University

of Hawaii, pers. comm. 2005). The most recent complete monitoring for this species was conducted in 2005 (Service Kauai bog monitoring database 2005).

SUMMARY OF THREATS

The greatest threat to *Astelia waialealae* at this time is the lack of regeneration. Two other major threats to this species include feral pigs and nonnative plants, which are believed to be a major cause of the decline of this species throughout its range. Feral pigs have been fenced out of the three bogs where *A. waialealae* currently occurs, but the fences must be continually maintained to prevent incursion. Nonnative plants have been greatly reduced in all three fenced bogs, and are not found in the immediate vicinity of any *A. waialealae* individuals. This species is not recovering and continues to decline, even though the known threats of feral pigs and nonnative plants have been controlled over the past nine years. This species is represented in an *ex situ* collection.

LISTING PRIORITY:

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	**Imminent**	Monotypic genus	1
		Species	**2***
		Subspecies/population	3
	Non-imminent	Monotypic genus	4
		Species	5
		Subspecies/population	6
Moderate to Low	Imminent	Monotypic genus	7
		Species	8
		Subspecies/population	9
	Non-imminent	Monotypic genus	10
		Species	11
		Subspecies/population	12

Rationale for listing priority number:

Magnitude:

The major threat to this species currently is the lack of regeneration and the low numbers of individuals. The species is highly threatened by pigs that prey upon the species, trample plants and seedlings, degrade and/or destroy habitat, and spread the nonnative plant species *Juncus planifolius* and *Andropogon virginicus* that compete with *Astelia waialealae*. Threats to the plant habitat, mixed montane bog, of *A. waialealae* and to individuals of this species occur over most of its range, and are expected to continue or increase without control or eradication. Pigs have been fenced out of the three bogs where *A. waialealae* currently occurs; however, without continued monitoring and maintenance of those fences, pigs from surrounding areas can easily

access fenced areas. These nonnative plants are being controlled within the three fenced bogs, but will probably never be completely eradicated because new propagules are constantly being dispersed into the fenced area from surrounding, unmanaged lands.

Imminence:
Threats to *Astelia waialealae* from pigs and nonnative plants are imminent because they are ongoing. In addition, the cause for the lack of regeneration has not yet been determined.

Yes ___ Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted?
No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process.

DESCRIPTION OF MONITORING:
We have incorporated additional information on this species from our files, including personal communications with Steve Perlman, National Tropical Botanical Garden in 1996 and 1997; Clyde Imada, Bernice Pauahi Bishop Museum in 1997, and Joan Canfield, Service in 1996. In addition, we have incorporated the most recent supplement to the *Manual of the Flowering Plants of Hawaii* (Wagner and Herbst 2003). In 2004 the Pacific Islands office contacted the following species experts: Bob Hobdy, retired from Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Art Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. New information on status, range, and management were provided by Steve Perlman and Marie Bruegmann of the Service in 2004. In 2005 we contacted the species experts listed below and confirmation of the status of *Astelia waialealae* was provided by Marie Bruegmann of the U.S. Fish and Wildlife Service and Patty Moriyasu of the Volcano Rare Plant Facility. In addition, a complete survey of the species was conducted in 2005 by the Service and the Hawaii Division of Forestry and Wildlife (Service Kauai bog monitoring database 2005).

The Hawaii Natural Heritage Program identified this species as critically imperiled (Hawaii Natural Heritage Program Database 2004). Based on the International Union for Conservation of Nature and Natural Resources Red Plant Data Book rarity categories, this species is recognized as Endangered (at risk of extinction) by Wagner *et al.* (1999b).

This level of monitoring is appropriate to update the status of the species, since the populations are monitored in detail one to two times a year by the Service and the results are included in this assessment.

COORDINATION WITH STATES
In October 2004 we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. Vickie Caraway, the State

botanist, reviewed the information for this species and provided no additional information or corrections (V. Caraway, pers. comm. 2005).

LITERATURE CITED and REFERENCES:

List all experts contacted:

Name	Date	Place of Employment
1. Joel Lau	June 28, 2005	Hawaii Natural Heritage Program
2. Art Medeiros	June 28, 2005	U.S.G.S. Biological Resources Discipline
3. Jim Jacobi	June 28, 2005	U.S.G.S. Biological Resources Discipline
4. Rick Warshauer	June 28, 2005	U.S.G.S. Biological Resources Discipline
5. Hank Oppenheimer	June 28, 2005	Maui Land and Pineapple Company
6. Kapua Kawelo	June 28, 2005	U.S. Army
7. Dave Lorence	June 28, 2005	National Tropical Botanical Garden
8. Steve Perlman	June 28, 2005	National Tropical Botanical Garden
9. Ken Wood	June 28, 2005	National Tropical Botanical Garden
10. Marie Bruegmann*	July 13, 2005	U.S. Fish and Wildlife Service
11. Vickie Caraway	June 14, 2005	Hawaii Division of Forestry and Wildlife
12. Patty Moriyasu*	June 22, 2005	Volcano Rare Plant Facility

*Provided new information on this taxon in 2005

List all databases searched:

Name	Date
1. Hawaii Natural Heritage Program	2004
2. U.S. Fish and Wildlife Service Kauai bog monitoring database	2005

Other resources utilized:

Center for Biological Diversity, Dr. Jane Goodall, Dr. E.O. Wilson, Dr. Paul Ehrlich, Dr. John Terborgh, Dr. Niles Eldridge, Dr. Thomas Eisner, Dr. Robert Hass, Barbara Kingsolver, Charles Bowden, Martin Sheen, the Xerces Society, and the Biodiversity Conservation Alliance. 2004. Hawaiian Plants: petitions to list as federally endangered species. May 4, 2004.

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Hawaii, Department of Land and Natural Resources. N.d.-b. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Molokai. Division of Forestry and Wildlife, Honolulu. 2 pp.
Hawaii, Department of Land and Natural Resources. N.d.-c. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Maui. Division of Forestry and Wildlife, Honolulu. 2 pp.
Hawaii, Department of Land and Natural Resources. N.d.-d. Summary of Title 13, Chapter 123, Game mammal hunting rules, island of Kauai. Division of Forestry and Wildlife, Honolulu.
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Loope, L.L. and A.C. Medeiros. 1992. A new and invasive grass on Maui. Newsletter of the Hawaiian Botanical Society 31: 7-8.
Loope, L.L. 1998. Hawaii and Pacific Islands. Pp. 747-774. In: M.J. Mac, P.A. Opler, C.E. Puckett Haecker, and P.D. Doran (eds.). Status and Trends of the Nation's Biological Resources, Volume 2. U.S. Department of the Interior, U.S. Geological Survey, Reston, VA.
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Medeiros, A.C., L.L. Loope, P. Conant and S. McElvaney. 1997. Status, ecology, and management of the invasive plant, *Miconia calvescens* DC (Melastomataceae) in the Hawaiian Islands. Bishop Mus. Occas. Pap.48: 23-36.
Medeiros, A.C., L.L. Loope, T. Flynn, S.J. Anderson, L.W. Cuddihy, and K.A. Wilson. 1992. Notes on the status of an invasive Australian tree fern (*Cyathea cooperi*) in Hawaiian rain forests. American Fern Journal 82: 27-33.
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Smith, C.W. 1985. Impact of alien plants on Hawai`i's native biota: in Stone, C.P., and J.M. Scott (eds.), Hawai`i's Terrestrial Ecosystems: Preservation and Management. Coop. Natl. Park Resources Stud. Unit, Univ. Hawaii, Honolulu, pp. 180-250.

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes to the candidate list, including listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all 12-month petition findings, additions of species to the candidate list, removal of candidate species, and listing priority changes.

Approve: Acting _____ 11/16/05
Regional Director, Fish and Wildlife Service Date

_____

Concur: _____ August 23, 2006
Director, Fish and Wildlife Service Date

Do not concur: _____ _____
Director, Fish and Wildlife Service Date

Date of annual review: August 20, 2005
Conducted by: Marie M. Bruegmann, Pacific Islands FWO
Plant Recovery Coordinator

Comments:
PIFWO Review

Reviewed by: Christa Russell_____ Date: September 8, 2005
Plant Conservation Program Leader

Gina Shultz_____ Date: October 13, 2005_
Assistant Field Supervisor,
Endangered Species

Patrick Leonard_____ Date: October 13, 2005
Field Supervisor